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Incidence of Malignant Neoplasms in Children Attending Social Security Hospitals in Mexico City

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An increase in neoplasms in Mexican children has been reported. In 1991, the incidence in children from Mexico City (MC) was 70 (× 10^6 child/year), although this rate might be underestimated. The aim of the present study was to estimate the incidence of malignant neoplasms in children resident in MC attending Social Security (SS) hospitals. This study was a retrospective hospital survey. All records of childhood malignant neoplasms diagnosed between 1992 and 1993 in the two SS hospitals which attend childhood neoplasms in MC were reviewed. Histopathological diagnoses were reevaluated and incidence rates (× 10^6 child/year) in terms of age, sex, and place of residence were estimated.

A total of 667 cases were found for the period of study, of which 199 corresponded to residents of MC. The neoplasms with highest prevalence were leukemias (39.2%), lymphomas (17.6%), and central nervous system tumors (12.6%). A general incidence of 94.3 was found, which was highest in children under 5 years of age. Leukemias had an incidence of 36.4, lymphomas of 15.2, and central nervous system tumors of 12.0. Prevalence was higher in boys (male/female ratio of 1.6). As for the place of residence, the highest incidence corresponded to children living in the southern areas of MC. Eighty percent of the leukemias were acute lymphoblastic, while 54% of solid neoplasms were classified as stages III and IV. In conclusion, the incidence of malignant neoplasms in children resident in MC treated at SS hospitals is consistent with that found worldwide, and also with the Latin American pattern. Med. Pediatr. Oncol. 29:208–212, 1997.
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Key words: childhood cancer; epidemiology; incidence rates; pediatric neoplasms

INTRODUCTION

Although cancer in children under 15 years of age represents 1–3% of overall neoplasms [1,2], there are important reasons to study it:

1. Studies that deal with the description of time, place, and personal characteristics as well as risk factors of childhood neoplasms are scarcer than those conducted among adults [1].
2. In some countries, neoplasms have become the second cause of death in the population under 15 years of age [3,4].
3. Even though the etiology of childhood cancer is unknown, there is evidence that exposure to certain environmental factors (such as benzene derivatives and pesticides) and exposure to electromagnetic fields, in addition to factors like parental occupation, can cause neoplasms in the pediatric population. This implies that cancer in children may be prevented [1,5,6].
4. Progress in the treatment of childhood cancer has allowed an increase in the number of patients that survive 5 years after diagnosis. However, the impact that the neoplasm and its treatment produce on the growth and development of the child is extremely strong, let alone the emotional impact on the family and the effects on the patient's school life [7].

Cancer incidence in children differs depending on the country. In general, the rates vary from 100 to 150 (× 10^6 child/year) [8]. In the United States, the incidence is 137 in the white and 121 in the black population [9]; in England, the rate is 109 [8]; in France, 137 [10]; in Italy,

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141 [8]; in Denmark, 138 [11]; and in Latin American countries, such as Cuba and Argentina, the incidence rates are 91 and 106, respectively [12,13].

In Mexico, a study undertaken among children resident in Mexico City (MC) showed a tendency to increase; however, the rate for 1991 was 70 [14], which is lower than that reported worldwide. The aim of the present report is to present data on the incidence rates found in a study of children from MC treated at Social Security (SS) hospitals.

MATERIALS AND METHODS

Type of Study

This was a retrospective hospital survey.

Population

The MC metropolitan area is one of the largest in the world and is located within two federate entities of the Mexican Republic: the State of Mexico and the Federal District. The latter is known as MC and has a population of 8,250,000 inhabitants. Several welfare institutions offer medical care. The largest is the Instituto Mexicano del Seguro Social (Mexican Institute for Social Security [SS]), which attends 50% of the Mexican population, mainly workers and their families, both resident and nonresident in MC. In fact, the SS registers 40% of all malignant neoplasms found in MC and in the rest of the country [4,15,16].

The present study comprised the population under 15 years of age resident in MC and treated at the SS. Children with malignant neoplasms in MC are referred to either one of the two SS hospitals which treat these cases: 1) Hospital de Pediatría del Centro Médico Nacional Siglo XXI (Pediatric Hospital of the National Medical Center) and 2) Servicio de Hematología y Oncología Pediátrica del Hospital General del Centro Médico La Raza (Pediatric Oncology and Hematology Departments of the General Hospital of La Raza Medical Center). Both hospitals have the technology and specialists necessary for diagnosis and treatment of childhood neoplasms, therefore many children with cancer are referred there from other cities of the country. It is important to mention that clinical records specify whether or not the patient is a resident of MC. These two hospitals attend 50% of children younger than 15 years of age resident in MC.

Numerators

The number of children with malignant neoplasms treated at the two above-mentioned hospitals during the years of 1992 and 1993 was obtained from the following sources: 1) the clinical files of each hospital and 2) the lists of patients of the hematology, oncology, neurosurgery, and pathology departments. Once the number of treated cases was obtained, the corresponding clinical records were reviewed. Whenever a patient had been registered in both hospitals—very few cases—duplicate data were avoided by considering only the first medical history. A total of 667 cases of children with malignant neoplasms were diagnosed and registered during the studied years at the selected hospitals; 199 of them (30%) were residents of MC. These 199 cases constitute the numerator for calculation of incidence.

Denominators

The SS holds a very precise record of the population that receives medical care; therefore, the population under 15 years of age resident in MC during 1992 and 1993, needed to calculate the incidence, was obtained from the SS Medical Information and Planning Coordination [17]. Denominators (child/year at risk) were obtained by adding the populations of 1992 and 1993; the average male population for the years of study was 1,073,644 and the average female population was 1,059,050. Since the population treated at SS hospitals and clinics is administratively divided into four regions (northeast, northwest, southeast, and southwest), the population for each of these regions was also obtained to calculate the corresponding rates.

Diagnostic Criteria

All cases of leukemia had bone-marrow cytomorphological diagnoses while solid tumors had histopathological diagnoses. To validate histopathological diagnoses in solid neoplasms, 160 cases were randomly selected for reevaluation: a pathologist ignoring the original diagnoses reviewed the slices; in two cases the new diagnoses differed from those registered in the records (medulloblastoma instead of anaplasic astrocytoma in one case and mixed cellularity Hodgkin's disease instead of nodular sclerosis in the other).

Study Variables

A data collection leaflet was designed which included the variables of interest to this study: age, sex, type of neoplasia, and stage at diagnosis; histopathological study; date of diagnosis and place of residence (SS administrative region).

Data Standardization

Data were collected by a physician and a nurse, once they knew how to obtain the study variables from the records and had proved to be consistent.

Analysis

Neoplasms were classified according to Birch and Marsden [18]. Mean annual incidence rates, general and specific to each neoplasia, were calculated for the 2 years of study and stratified by age and sex. The rates were standardized with the direct method, using the world

TABLE I. Frequency, Mean Annual Cancer Incidence (ACI), and Age Standardized Rates (ASR) in Children Treated at SS Hospitals, Resident in MC (1992–1993)

Type of neoplasms	Total n (%)	ACI[a]	ASR
Leukemias	78 (39.2)	36.6	36.4
Lymphomas and other reticuloendothelial neoplasms	35 (17.6)	16.4	15.2
Hodgkin's disease	18 (9.0)	8.4	7.7
Non-Hodgkin's lymphoma	17 (8.6)	8.0	7.4
Histiocytosis	1 (0.5)	0.5	0.5
Central nervous system	25 (12.6)	11.7	12.0
Sympathetic nervous system	6 (3.0)	2.8	3.2
Retinoblastoma	5 (2.5)	2.3	2.9
Kidney tumors	9 (4.5)	4.2	4.5
Hepatic tumors	1 (0.5)	0.5	0.9
Bone tumors	9 (4.5)	4.2	3.8
Soft tissue tumors	10 (5.0)	4.7	4.8
Germ cell tumors	17 (8.6)	8.0	8.6
Carcinomas	3 (1.5)	1.4	1.3
Total	199 (100)	93.3	94.1

[a]Rates per 10^6 child/year.

population under 15 years of age as reference [19]. Incidence in the four SS administrative regions was also estimated. All rates are reported by 10^6 child/year.

To determine prevalence of leukemia subtypes and the stage of solid neoplasms at diagnosis, the complete data base was taken into account. From the total of 667 cases, 291 were leukemias; however, 255 had histological subtype classified according to the FAB (French American British) classification. For solid tumors, the stage at diagnosis was established in only 187 cases.

RESULTS

The highest rates were found for leukemias (39.2%), lymphomas (17.6%), central nervous system tumors (CNST) (12.6%), germ cell tumors (GCT) (8.6%), and soft tissue tumors (STT) (5%). Other neoplasms had lower percentages (Table I).

The general mean annual incidence (age standardized rates [ASR]) for the 2 years of study was 94.3. Leukemias had an incidence of 36.4; lymphomas 15.2; CNST 12.0; GCT 8.6; and STT 4.8. Incidence was lower for other neoplasms (Table I).

Stratification by age group revealed that children under 5 years of age were the most affected, followed by the group of 10–14 years, and last the group of 5–9 years of age. In general, neoplasms were more prevalent in boys (male/female [M/F] ratio = 1.6); incidence was higher in females only in kidney tumors and in STT (M/F ratios of 0.3 and 0.6, respectively) (Table II).

Regarding the place of residence, the highest incidences were found for the southwestern and southeastern regions of MC (rates of 103.5 and 101.5, respectively) (Table III).

Finally, 80.0% of leukemias were acute lymphoblastic and subtype L_1 was predominant; the other 20.0% were acute myeloblastic, with predominancy of subtypes M_3, M_4, and M_5. As for solid neoplasms, 54.0% were classified as stages III and IV (33.7 and 20.3%, respectively) (Table IV).

DISCUSSION

The main difficulty in calculating the incidence of childhood cancer is to obtain the numerators and denominators [20]. The first depends on the way diagnosis is established and the number of cases defined; the latter depends on how the population at risk is determined.

We consider that, in the present study, these aspects were covered to a great extent, since data were collected from hospitals with qualified staff and technology needed for diagnosis. Also, hospital departments where cases could have been registered (hematology, oncology, neurosurgery, ophthalmology, and pathology) were consulted. The survey to obtain data was exhaustive, to reduce information loss which could contribute to underestimated rates. Furthermore, results from the random histopathological review were highly consistent with original diagnoses—some discrepancy was found in only two cases—which validates diagnostic data. Therefore, this study provides a more precise view of the incidence of malignant neoplasms in children resident in MC treated at SS hospitals than previous studies in which clinical records were consulted at hospitals, but other hospital departments were not included nor a histopathologic diagnosis made. The mean incidence rate (94.3×10^6 child/year) obtained for the years of study agrees with worldwide reports for developing countries [21]. Present results are coincident with the Latin American pattern, where leukemias, lymphomas, and CNST are the most prevalent neoplasms, and are also consistent with other studies conducted among residents of MC as well as with reports from other Latin American countries [12–14].

As for other neoplasms, we consider that retinoblastoma and GCT deserve special attention. The incidence obtained for retinoblastoma was lower than that reported previously (2.9 vs. 7.1) [14]. This is probably not due to an underestimate—considering the controlled collection of data—but to the fact that parents of children treated at SS hospitals have higher income and educational levels than the average population of MC. Interestingly, the incidence is similar to that of developed countries [22].

High incidence was obtained for GCT (8.6), consistent with previously reported rates [14] and similar to the rates found in countries such as Australia (6.7), New Zealand (8.8), and Argentina (9.3) [8,13]. Special care was taken not to include benign tumors, such as sacrococcygeus teratomas, which might falsely increase the

TABLE II. Specific Cancer Incidence by Age and Sex and Age Standardized Rates (ASR) in Children Treated at SS Hospitals, Resident in MC (1992–1993)

	Age group (years)								ASR: 0–14		
	<1		1–4		5–9		10–14				Ratio
Type of neoplasms	M[a]	F	M	F	M	F	M	F	M	F	M/F
Leukemias	—	24.2	67.1	34.1	27.4	33.0	41.9	27.3	41.9	31.2	1.3
Lymphomas	—	—	10.1	6.8	29.9	12.7	29.9	9.1	23.3	9.4	2.5
Hodgkin's disease	—	—	—	6.8	19.9	2.5	20.9	—	14.0	2.8	5.0
Non-Hodgkin's lymphoma	—	—	10.1	—	10.0	10.2	9.0	9.1	9.3	6.6	1.4
Histiocytosis	—	—	3.4	—	—	—	—	—	0.9	—	—
Central nervous system	49.3	—	10.1	3.4	22.5	2.5	10.0	15.2	16.8	6.6	2.5
Sympathetic nervous system	—	24.2	6.7	—	5.0	—	3.0	—	4.7	0.9	5.2
Retinoblastoma	24.7	—	6.7	3.4	—	2.5	—	—	2.8	1.9	1.5
Kidney tumors	—	—	—	17.1	—	—	—	6.1	1.9	6.6	0.3
Hepatic tumors	—	24.2	—	—	—	—	—	—	—	0.9	—
Bone tumors	—	—	—	—	7.5	—	12.0	6.1	6.5	1.9	3.4
Soft tissue tumors	—	24.2	—	3.4	7.5	2.5	3.0	9.1	3.7	5.7	0.6
Germ cell tumors	24.7	—	26.8	3.4	2.5	5.1	3.0	9.1	10.3	5.7	1.8
Carcinomas	—	—	—	—	—	2.5	6.0	—	1.9	0.9	2.1
Total	98.7	96.8	130.9	71.6	102.3	60.8	108.8	82.0	114.7	71.7	1.6

[a]Rates × 10^6 child/year.
M, male; F, female.

TABLE III. Mean Annual Cancer Incidence (ACI) and Age Standardized Rates (ASR) in Children Treated at SS Hospitals by Administrative Region in MC (1992–1993)

Administrative region	n	ACI[a]	ASR
Northwest	36	64.1	64.2
Northeast	44	88.2	92.9
Southwest	55	100.1	103.5
Southeast	64	102.8	101.5
Total	199	93.3	94.3

[a]Rate × 10^6 child/year.

TABLE IV. Types of Leukemia and Stage of Diagnosis of Solid Neoplasms in Children Treated at SS Hospitals, Resident in MC (1992–1993)

			Solid tumors		
Leukemias	n	%	(stage)	n	%
Acute lymphoblastic	204	80.0			
L_1	128		I	43	23.0
L_2	74				
L_3	2				
Acute myeloblastic	51	20.0	II	42	22.5
M_1	1		III	63	33.7
M_2	4				
M_3	15				
M_4	14		IV	38	20.3
M_5	11				
M_6	4		V	1	0.5
M_7	2				
Total	255	100.0		187	100.0

incidence of GCT; therefore, we consider that the reported incidence is real. Further analytic epidemiologic studies are necessary to find the etiological factors of this type of cancer.

As to sex, most studies report a M/F ratio of 1.1–1.3 [1,8,10–12]; only Drut et al. [13] in Argentina and McWhirter and Petroeschevsky [23] in Australia found a higher ratio (1.58 and 1.57, respectively). Our data agree with the latter (M/F ratio 1.6) and the difference is basically due to Hodgkin's disease and sympathetic nervous system. This ratio is consistent with the previous study performed on the same population [14], albeit with less precise data than the present, a reported ratio of 1.4.

Another interesting aspect deals with the fact that the incidence was higher in the southern regions of MC. This is consistent with previous studies [14,24], so the results should now be considered as evidence. Further analytic epidemiologic studies are needed to elucidate causes; however, if etiological factors related to industry are to be considered, it must be considered that, although MC's industrial zone is located in the northern region, the highest air pollution rates are found in the southern area [25].

On the other hand, we consider that the present study contributes important facts from the clinical point of view. First, leukemia type and subtype rates were obtained, similar to those reported for children from other countries [26]. These rates may constitute a good pre-test probability indicator for patients in which this diagnosis is suspected [27]. Second, regarding their stage, more than 50% of solid neoplasms were classified as III and IV, which indicates late diagnoses and directly affects prognoses. This situation has also been found in other countries with similar economies to Mexico [2]. Undoubtedly, a greater educational effort must be made to reach pediatricians and other physicians who treat children, to inform them of the prevalence of childhood neoplasms, and to emphasize the importance of referring

patients to hospitals with the necessary staff and technology for early diagnosis.

We conclude that this study—more precise than those previously published in Mexico because of the way in which data were collected—indicates that children treated at MCSS hospitals have an incidence similar to that reported worldwide, and consistent with the Latin American pattern, as well as its own peculiarities. However, further prospective studies are necessary to improve the precision of data.

On the other hand, it is important to recognize the need for efficient registration of malignant neoplasms; otherwise, their tendency in the future and changes in their pattern of appearance will not be clear, but above all, because these data will provide a basis for the planning of better health services and child care programs in Mexico.

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